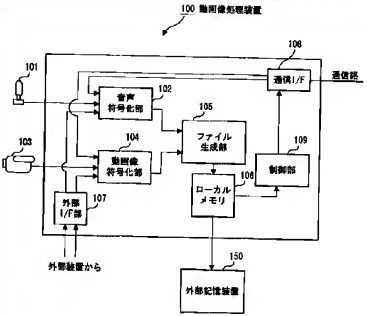
JAPANESE [JP,2003-289495,A]

[Translation done.]

Drawing selection Representative draw



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* NOTICES *

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2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to the dynamic image processor which records the video encoded information which comprises the key-frame generated by prediction coding in a frame, and the non-key-frame generated by interframe predictive coding by a predetermined file format, It is related with improvement of the function which creates the index which specifies in detail the key-frame stored in the file.
[0002]
[Description of the Prior Art]While coding the dynamic image information inputted from a camera, for example as one of the devices which has a time-varying-image-processing function and generating video encoded information, The audio signal inputted from the microphone is coded, voice coding information is generated, and the video recorder which multiplexes and records these video encoded information and voice coding information is known.
[0003]In this kind of device, there is a thing using the

compression technology of MPEG-4 when coding dynamic image information and an audio signal.
[0004]Now, in the MPEG-4 animation compression technology standardized in ISO (International Organisation for Standard), a picture is compressed into a time series and the highly efficient compression coding method is provided.
[0005]The picture which constitutes the video of MPEG-4 can be classified into three kinds, I picture (it is also called a key-frame), P picture, and B picture.
[0006]I picture is an Intra coded image, i.e., a frame inner code-ized picture.
It is the picture to which intra coding of all the pictures is carried out without using inter frame prediction.

[0007]P picture is a Predictive coded image, i.e., an inter-frame forward direction prediction-coding picture.
The picture is constituted by performing prediction from I or P picture.

[0008]B picture is Bidirectionally Predictive encoded information, i.e., a bidirectional prediction-coding picture.
The screen comprises forward direction inter-frame-prediction numerals, opposite direction inter-frame-prediction numerals, and interpolation inter-frame-prediction numerals.

[0009]When saving the video coding stream generated by the animation compression technology of MPEG-4 mentioned above at a storage medium, generally multiplex [of it] is carried out to a voice coding stream, and it is saved as one file.
[0010]There are MPEG-4 file format (henceforth MP4) etc. as an example of a concrete file format. MP4 is standardized as some systems of MPEG-4.
[0011]On the other hand, when reproducing the file accumulated in the storage medium, a user demands a random access function, accesses the arbitrary video in the video coding stream recorded into the file according to this demand, and starts reproduction sequentially from the video concerned.
[0012]However, as mentioned above, the MPEG-4 video coding stream comprises an I picture, a P picture, and a B picture, and even if it accesses arbitrary video, a perfect image may not be decoded from the start.
[0013]That is, since I picture is a frame inner code-ized image and the perfect image of one sheet can be decoded only by itself if reproduction is started from the position of I picture when a user does random access to a file, it is satisfactorily renewable.
[0014]However, if it is going to start reproduction from the position of P picture or B picture when a user does random

access, In order to decode the screen constituted since these are prediction-coding images, the frame information before the frame is needed, a perfect image will be decoded, and the disordered video will be displayed on a screen.

[0015]When a user does random access and it is going to access P picture or B picture as an evasion measure of such a situation, there is a method of making it make decoding start from I picture in front of that automatically. By applying such a method, the reproduction at the time of random access can be started, without displaying the disordered video.

[0016]Such measures are taken also in the conventional video recorder which has a video recording function according to MP4 file format mentioned above.

[0017]Specifically, the number of bytes of the offset of the position of all the frames from the head of a file and the frame numbers of I picture are enumerated by the header of MP4.

[0018]Of course, the header information of MP4 has realized the random access function mentioned above by using these two information at worst, although various information is included besides two information (the number of bytes of offset, the frame number of I picture) mentioned above.

[0019]For example, when a frame number is the video of N, it can respond to random access reproduction by the following methods using an offset value. Here, the key-frame shall be inserted like 0, 10, 20, and -- every ten frames from the frame number No. 0.Offset from the file head of a frame is set to Pn (0 <=n<N).

[0020]In this case, if it assumes that a user does random access to the x-th frame, a value smaller than x will be searched from the table where I pictures are enumerated. x' becomes I picture in front of the x-th frame as a result of this search.

[0021]next -- x -- ' -- a file -- inside -- a position -- MP -- four -- a header -- from -- asking -- things -- predetermined -- a frame -- x -- ' -- from -- it can access .

[0022]However, in this conventional video recorder, since it is necessary to enumerate the frame numbers of I picture to MP4 header, the number which the frame number of I picture enumerates will also increase as a frame number increases.

[0023]Therefore, since the table which the overhead about processing (listing of the frame number of I picture) of a header increases, and enumerates the frame numbers of I picture became variable length according to a frame number, processing was complicated.

[0024]

[Problem(s) to be Solved by the Invention]Thus, with the

conventional video recorder recorded as one file, the video encoded information which comprises a key-frame (I picture) and a non-key-frame (P and B picture). Since the index area (MP4 header) which stores the index information data (for example, frame number) of the key-frame stored in the file was variable length, The number which enumerates the index information data of a key-frame to an index area also increased as the frame number increased, and there was a problem that the overhead about the writing of the index information data to this index area increased.

[0025]Since the index area which enumerates the index information data of a key-frame became variable length according to a frame number, there was a problem that processing became complicated.

[0026]This invention suppresses overhead increase of the index area which removes the above-mentioned problem and enumerates the index information data of a key-frame, and. It aims at providing the dynamic image processor which can also attain simplification of management preventing an index area from increasing as the number of key-frames increases.

[0027]

[Means for Solving the Problem]This invention to achieve the above objects the invention according to claim 1, When a key-frame generated by prediction coding in a frame and a non-key-frame generated by interframe predictive coding record video encoded information intermingled by a time series by a predetermined file format, A dynamic image processor which creates an index which specifies a key-frame stored in said file is characterized by comprising:

A fixed-length index area which followed a memory for file deployment at said file format is secured at the time of record of said video encoded information, A write-in processing means which carries out the additional writing of the key frame information for specifying the key-frame concerned as free space of said index area whenever said key-frame is stored in this file.

An infanticide processing means to thin out key frame information already memorized in this index area, and to secure free space when it is judged that said index area exceeds a memory permissible dose by newly writing in said key frame information.

[0028]The invention according to claim 2 comprises a processing means which thins out by turns key frame information said infanticide processing means is already remembered to be in an invention given in above-mentioned claim 1.

[0029]The invention according to claim 3 comprises a processing means which thins out key frame information

said infanticide processing means is already remembered to be according to importance of a key-frame in an invention given in above-mentioned claim 1.
[0030]The invention according to claim 4 is characterized by being a sample number of a key-frame to which said key frame information corresponds in an invention of a statement either of above-mentioned claims 1 thru/or 3.
[0031]The invention according to claim 5 is characterized by being the regeneration time of a key-frame when said key frame information corresponds in an invention of a statement either of above-mentioned claims 1 thru/or 3.
[0032]The invention according to claim 6 is characterized by being the information which shows an offset valve position from a head of said file of a key-frame to which said key frame information corresponds in an invention of a statement either of above-mentioned claims 1 thru/or 3.
[0033]According to the invention given in above-mentioned claim 1, when an index area which writes in key frame information is made into fixed length and an index area exceeds a memory permissible dose, key frame information already memorized in this index area is thinned out, and new frame information can be added. Even if the number of key-frames to input increases by this, it is not necessary to increase the number of key frame information enumerated to an index area, and can fix an overhead about writing of key frame information to this index area, and. Management of an index can also be simplified by always maintaining an index area at fixed length.
[0034]Since according to the invention given in above-mentioned claim 2 already memorized key frame information is thinned out by turns when an index area exceeds a memory permissible dose, An interval as an index of key frame information after record can be kept almost equivalent, and also when carrying out random access to this key frame information and reproducing, a bias of an access interval can be made small.
[0035]Since already memorized key frame information is thinned out according to importance of a key-frame according to the invention given in above-mentioned claim 3, For example, when recording a television picture, usage of reproducing from these important portions becomes possible by making a key-frame just behind commercials, a key-frame at the time of a scene change, etc. into the highest priority.
[0036]According to the invention given in above-mentioned claim 4, key frame information is written with a sample number of an applicable key-frame, accesses a key-frame applicable based on this sample number, and can carry out a reproduction start.
[0037]According to the invention given in above-mentioned

claim 5, key frame information is written with regeneration time of an applicable key-frame, accesses a key-frame applicable based on this regeneration time, and can carry out a reproduction start.

[0038]According to the invention given in above-mentioned claim 6, key frame information is written with information which shows an offset valve position from a head of the file of an applicable key-frame concerned, accesses a key-frame applicable based on this offset valve position, and can carry out a reproduction start.

[0039]

[Embodiment of the Invention]Hereafter, an embodiment of the invention is described in detail with reference to an accompanying drawing.

[0040]Drawing 1 is a block diagram showing the entire configuration of the dynamic image processor 100 concerning this invention.

[0041]This dynamic image processor 100, The microphone part 101 which changes a sound into an audio signal, the audio coding section 102 which codes the audio signal inputted from microphone part 101 grade, and video are photoed. Dynamic image information. On a basis the video encoded information inputted from the voice coding information and the video coding part 104 which are inputted from the camera part 103 to generate, the video coding part 104 which codes the dynamic image information inputted from the camera part 103 grade, and the audio coding section 102 the file of a predetermined file format. By the file generating part 105 and the file generating part 105 to generate. The file generated. Control of the external-interface (I/F) part 107 which manages the interface at the time of inputting an audio signal and dynamic image information, the communication-interface (I/F) part 108 which manages an interface with a channel, and the whole device from the local memory 106 which is held and is passed to the external storage 150, and an external device. The control section 109 to perform is provided and it is constituted.

[0042]In this dynamic image processor 100, the dynamic image information inputted from the audio signal inputted from the microphone part 101 and the camera part 103, for example is recorded on the outboard recorder 150 by the following methods.

[0043]In this case, it is coded by the audio coding section 102 and the audio signal inputted from the microphone part 101 is inputted into the file generating part 105 as voice coding information. The sound encoding method by this audio coding section 102 is set to MPEG-4 Audio AAC, for example.

[0044]On the other hand, it is coded by the video coding

part 104 and the dynamic image information inputted from the camera part 103 is inputted into the file generating part 105 as video encoded information. The video encoding method by this video coding part 104 is set to MPEG-4 Video, for example.

[0045]The file generating part 105 generates a file according to a predetermined file format (this example MP4) based on the voice coding information and video encoded information of MPEG-4 inputted, and develops a file image to the local memory 106.

[0046]After the file generating completion by the file generating part 105, the file image developed by the local memory 106 is transmitted to the external storage 150, and is memorized.

[0047]Although it is considered as the input from the microphone part 101 about the audio signal in explanation here, It can come and does not restrict, but the audio signal recorded on the file may be inputted, the audio signal from external devices, such as television, may be inputted via the external I/F part 107, or it may be made to input the audio signal which is flowing into the network via the communication I/F part 108.

[0048]Although it is considered as the input from the camera part 103 about dynamic image information, It can come and does not restrict, but the dynamic image information recorded on the file may be inputted, the dynamic image information from external devices, such as television, may be inputted via the external I/F part 107, or it may be made to input the dynamic image information which is flowing into the network via the communication I/F part 108.

[0049]It may be made it not only to to memorize to the external storage 150, but to transmit to the device in other networks via the control section 109 and the communication I/F part 108 about the treatment of the file image developed by the local memory 106.

[0050]Next, it explains in more detail about the file generating operation in the file generating part 105.

[0051]Like ****, in the audio coding section 102 of this video memory storage 100. For example, it codes by (MPEG-4 Audio AAC) and the audio signal inputted from the microphone part 101 is outputted, and the video coding part 104 codes by (MPEG-4Video), and outputs the dynamic image information inputted from the camera part 103, for example.

[0052]Since the compression coding method of (MPEG-4 Video) is adopted in the video coding part 104 in that case, I picture which used only the dynamic image information in one frame, and was coded based on the dynamic image information inputted from the camera part 103, P picture

coded by the inter frame prediction between front frames and B picture coded using the inter-frame forecasting method of a forward direction and an opposite direction between order frames are generated.

[0053]In the file generating part 105 which the above-mentioned I picture, P picture, and B picture are intermingled, and is inputted by a time series on the other hand, one file is generated according to MP4 (file format of MPEG-4) based on these input.

[0054]This file generating processing is performed developing the file image according to the MP4 above-mentioned file format to the local memory 106.

[0055]Here, the composition of MP4 file format is explained with reference to drawing 2.

[0056]Drawing 2 is a figure showing MP4 file image developed by the local memory 106 at the time of the file generating in the file generating part 105.

[0057]The composition of MP4 file format comprises a Moov box (header information storage) which stores header information, and a Mdat box (encoded information storage) which stores actual encoded information so that drawing 2 may also show. Both a Moov box and a Mdat box are variable length fields.

[0058]A Moov box A Chunk Offset box (offset information storing table), It comprises a Sample Size box (data size information storing table), a Time to Sample box (regeneration time information storing table), a Sync Sample box (sample-number information storing table), etc.

[0059]When the file generating part 105 generates a file based on the voice coding information and video encoded information to input, it secures the Moov box range 21 and the Mdat box range 22 as shown in drawing 2 in the local memory 106.

[0060]Voice coding information and video encoded information are stored in the Mdat box range 22. The storing method to the Mdat box range 22 of these voice coding information and video encoded information is arbitrarily storable if voice coding information and video encoded information are not divided into one or less frame.

[0061]On the other hand, the presentation time stamp (PTS) which is the position and regeneration time in the file concerned of voice coding information and video encoded information is stored in the Moov box range 21.

[0062]A fixed length area or a variable length area may be sufficient as the Moov box range 21 and the Mdat box range 22. Here, the Moov box range 21 and the Mdat box range 22 continue the following explanation as what is a fixed length area in the meaning which explains simply. More specifically, region length of M1 byte and the Mdat box range 22 is considered for the region length of the Moov

box range 21 as M 2-byte immobilization.
[0063]If the input of voice coding information and video encoded information is received, the file generating part 105, When the data length of these encoded information is compared with the free space of the Mdat box range 22 and this encoded information is judged [that it is storable in the Mdat box range 22, and], the encoded information concerned is stored in the Mdat box range 22.
[0064]It can come, simultaneously the file generating part 105 stores the top offset address, data size, and PTS from a start address of the Mdat box range 22 of this encoded information in the Moov box range 21 of the file concerned.
[0065]In the offset address of these, the Chunk Offset box 211 is stored in the Time to Sample box 213, and, as for the above-mentioned data size, the Sample Size box 212 and the above PTS are stored, respectively.
[0066]All of each of these boxes are variable-length boxes. That is, whenever encoded information is added, additional storing of each information corresponding to each of these boxes will be carried out separately.
[0067]In order to build a file as MP4 file format, other boxes are needed in addition to each of above-mentioned boxes, but only the box relevant to the file generating function of this invention is shown, and others are omitting here.
[0068]Now, when the encoded information inputted into the file generating part 105 is video encoded information, and when the video encoded information is a key-frame (I picture), the sample number of the key-frame concerned is added to the Sync Sample box 214 of the file concerned.
[0069]Here, the Sync Sample box 214 is a box of a fixed length area. When the file generating part 105 secures the Moov box range 21 and the Mdat box range 22 in the local memory 106 according to MP4 file format, it secures the Sync Sample box 214 of fixed-length size in this Moov box range 21.
[0070]Next, the detailed composition of the Sync Sample box 214 is explained.
[0071]Drawing 3 is a figure showing the table format of the Sync Sample box 214.
[0072]This Sync Sample box 214 comprises the number field 30 of entries, and the entry field 40.
[0073]The sample number of a key-frame is stored in the entry field 40 one by one, and the number of the entries (sample number of a key-frame) stored in the above-mentioned entry field 40 is stored in it in the number field 30 of entries.
[0074]As mentioned above, the Sync Sample box 214 cannot store the entry (sample number of a key-frame) beyond the number of memory permission entries of this

fixed length area because of a fixed length area.
[0075]So, in the file generating part 105 of this image processing device 100. When the entry field 40 of the Sync Sample box 214 is buried altogether, the addition of the entry which becomes further is enabled by thinning out some sample numbers of the key-frame already stored in this entry field 40, and securing free space.
[0076]An example is given and the infanticide processing by this file generating part 105 is explained in more detail.
[0077]Drawing 4 is a figure showing transition of the stored information of the Sync Sample box 214 concerning entry infanticide processing of the file generating part 105.
[0078]In this example, the number of memory permission entries of the entry field 40 in the Sync Sample box 214 is set to "10."
[0079]In the state where no sample numbers of the key-frame are stored to the entry field 40 of the fixed-length size which fulfills this condition, as shown in drawing 4 (a), "0" is stored in the number field 30 of entries.
[0080]In this state, when the sample number of a key-frame, for example, "0", is inputted, as shown in drawing 4 (b), the value of the number field 30 of entries is updated by "1", and the sample number "0" of the key-frame at this time is stored in the 1st field of the entry field 40.
[0081]Henceforth, if the sample numbers 10, 20, and 30 of a key-frame and every one -- are inputted one by one, The value of the number field 30 of entries is updated every [1] one by one, and the sample number "10" of the key-frame at this time, "20", "30", and -- are stored in the field of the 1st of the entry field 40, the 2nd, the 3rd, and -- one by one.
[0082]Drawing 4 (c) shows the stored condition when all of ten storage areas of the entry field 40 are buried by the storing process according to the above-mentioned procedure.
[0083]When the sample number "100" of a key-frame is inputted, from this state the file generating part 105, First, the 2nd of the entry field 40, the 4th, the 6th, and the 8th. After making the entry which deletes the already memorized entry to the 10th field, and has already been stored in it subsequently to the 3rd, the 5th, the 7th, and the 9th field into top alignment one by one, the value of the number field 30 of entries is updated to "5."
[0084]Further, the file generating part 105 stores the sample number "100" of the key-frame at this time in the 6th field of the entry field 40, as shown in drawing 4 (d), and it updates the value of the number field 30 of entries to "6" according to this.
[0085]The sample number of the key-frame which the file generating part 105 is after this the same procedure as the

above, and is inputted is stored in the free space of the entry field 40 one by one, And when the value of the number field 30 of entries is updated one by one according to this number of storing and all the storage areas of the entry field 40 are buried, The recording processing of the entry to this free space is continued thinning out by turns the entry already stored in the entry field 40 for example, in order of a storing region, and securing free space.

[0086]Drawing 5 is a flow chart which shows the sample-number adding processing of the key-frame to the entry field 40 in the file generating part 105.

[0087]By starting the recording processing of a file, the file generating part 105 inputs the video encoded information of a recording object one by one (Step S501), and judges whether this inputted dynamic image information is a key-frame (Step S502).

[0088]When video encoded information is judged not to be a key-frame here (step S502NO), subsequently the file generating part 105, Processing is ended, when it judges whether recording processing was completed (Step S503) and it is judged that recording processing was completed (step S503YES), When it is judged that recording processing is not completed (step S503NO), it returns to Step S501 and the following video encoded information is inputted.

[0089]On the other hand, when the video encoded information inputted at the above-mentioned step S501 is judged to be a key-frame (step S502YES), subsequently the file generating part 105, The inside of the Moov box range 21 secured to the local memory 106 in advance of the recording start according to MP4 file format, and the Mdat box range 22, It is judged whether the sample number of a key-frame can be added to the entry field 40 in the Sync Sample box 214 of the Moov box range 21 (Step S504).

[0090]The value of the number field 30 of entries of the Sync Sample box 214 is specifically checked, The propriety of the above-mentioned addition is judged by adding 1 to this value in the paddle exceeding the number of memory permission entries of the entry field 40 "10" (do you get it blocked and does the entry field 40 exceed a memory permissible dose by newly writing in the sample number of a key-frame or not?).

[0091]When the sample number of a key-frame is newly judged [that it can add and] here in the entry field 40 (step S504YES), After storing the sample number of the newly inputted key-frame in the entry field 40 and updating the value of the number field 30 of entries (Step S506), it returns to Step S503 and the input of the following video encoded information is continued.

[0092]On the other hand, when it is judged that the sample

number of a key-frame cannot newly be added to the entry field 40 (step S504NO), processing which thins out suitably the sample number of the key-frame already stored in the entry field 40 is performed (Step S505).

[0093]As mentioned above, the sample number of the key-frame already stored in the entry field 40 is thinned out by turns in order of a storing region, and, specifically, free space is secured, for example.

[0094]After this infanticide processing is completed, the free space which can memorize the sample number of a key-frame will be secured in the entry field 40.

[0095]After the file generating part 105 performs infanticide processing of the entry field 40 at Step S505 by this, It progresses to Step S506, the sample number of the newly inputted key-frame is stored in the free space of the entry field 40, and the value of the number field 30 of entries is updated according to this.

[0096]Then, the file generating part 105 returns to Step S501, and inputs the following video encoded information. And when this inputted video encoded information is a key-frame (step S502YES). A series of above-mentioned sample-number additional recording processings (step S504->S506 or step S504->S505->S506) are continued for this key-frame till the time of the end of record (step S503YES).

[0097]The sample number of the key-frame stored in Sync Sample214 box by the above processing, It is used as index information data at the time of accessing the key-frame memorized in the Mdat box range 22 of the file including this Sync Sample box 214 with a random access function, and reproducing.

[0098]If an example of reproduction motion is given, after recording the above-mentioned file on the external storage 150, this external device 150 is connected to video playback equipment, and employment of carrying out the random access of the MP4 above-mentioned file, and reproducing from this video playback equipment can be considered.

[0099]At this time, the sample number of the key-frame memorized in the entry field 40 in the Sync Sample box 214 of MP4 file is referred to with video playback equipment using a random access function, The key-frame in the frame stored in the Mdat box range 22 of the file is accessed, and reproduction is made to start sequentially from this key-frame.

[0100]Thus, in the dynamic image processor 100 of this invention. It hits carrying out a reproduction start from arbitrary key-frames with a random access function in the video encoded information recorded on the file, The index area which stores the key frame information (index information data) for directing a key-frame is made into fixed length, When a new key-frame is inputted under the

situation where this index area exceeds a memory permissible dose, Thinning out the already stored key frame information suitably, securing free space, and having added the key frame information corresponding to a key-frame new to this free space A sake, Even if the number of key-frames to input increases, it is not necessary to increase the number of key frame information enumerated to an index area, and can fix the overhead about the writing of the key frame information to this index area, and. Management of an index can also be simplified by always maintaining an index area to fixed length.

[0101]If it is made to thin out the already memorized key frame information by turns here when an index area exceeds a memory permissible dose, The interval as an index of the key frame information after record can be kept almost equivalent, and also when carrying out random access to this key frame information and reproducing, the bias of an access interval can be made small.

[0102]Although the key frame information (index information data) for specifying a key-frame is added to the header unit of a file in the above-mentioned example, the index information data concerned do not necessarily need to be in the header unit of a file, and may be in the arbitrary places of a file.

[0103]Index information data may be held in the form of file format with MP4 another file format. That is, it does not limit to MP4 file format, but another file format which realizes an equivalent function can also perform the same thing.

[0104]Especially in the above-mentioned example, although the sample number of the key-frame was mentioned as the example also in key frame information as index information data of a key-frame, index information data may use an offset value, regeneration time, etc. from a file head of not only this but a key-frame.

[0105]Also when using which key frame information of the above as index information data, it is the storing region (ChunkOffset box 211 of drawing 2 index area: when using an offset value.). When using regeneration time, the Time to Sample box 213 of drawing 2 is made into fixed-length size, What is necessary is just to perform infanticide processing which thins out the key frame information already memorized in this index area, and secures free space, when it is judged that an index area exceeds a memory permissible dose by newly writing in key frame information.

[0106]How to thin out index information data is not restricted to the processing thinned out by turns in order of a storing region like the above-mentioned example, either, and it may be made to thin out the key frame information corresponding to order from what has low importance, for

example according to the importance of a key-frame.
[0107]As an example of the importance of a key-frame, it is possible in file generating when recording a TV program to make the key-frame just behind commercials (CM), the key-frame of a portion corresponding at the time of a scene change, etc. into the highest priority, for example.
[0108]When the key-frame just behind CM is made into the degree of top priority and the above-mentioned recording file is played by this, for example, it is not necessary to access the I frame of the important contents just behind CM at random, to carry out a playback start from there, and to overlook important contents.
[0109]In addition, without limiting to the example which is described above and shown in a drawing, within limits which do not change the gist, this invention changes suitably and can be carried out.
[0110]
[Effect of the Invention]As explained above, according to this invention, the index area which writes in the key frame information for specifying a key-frame is made into fixed length, Thinning out the key frame information already memorized in this index area, and having secured free space, when it was judged that an index area exceeds a memory permissible dose by newly writing in key frame information A sake, Even if the number of key-frames to input increases, it is not necessary to increase the number of key frame information enumerated to an index area, and can fix the overhead about the writing of the key frame information to this index area, and. Management of an index can also be simplified by always maintaining an index area at fixed length.

[Translation done.]